Aqua est Dominus!

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Abstract: - This study examines visitor patterns at the Aquaticum Spa complex in Debrecen, Hungary, from 2019 to 2023, a period marked by significant challenges, including the COVID-19 pandemic and the Russian-Ukrainian war. The historic bathhouse, operating for nearly 200 years, has evolved into a comprehensive spa destination; the analysis covers its three indoor units: the thermal bath, the indoor aquapark, and the wellness hotel. Using panel regression with fixed effects, selected on the basis of the Hausman test, two hypotheses were tested regarding external influences on visitor numbers. COVID-19 case numbers did not significantly affect attendance. Among the pandemic-related restrictions, total facility closures and the requirement for guests to present a vaccination certificate substantially reduced visitor numbers, whereas the effects of mask mandates and of the vaccination requirement for employees were not statistically significant. No statistically significant effect of the war, inflation, or the energy crisis was detected; however, high multicollinearity among these variables limits the precision of the estimates, so the results should not be read as proof that no effect exists. The findings point to the sector's vulnerability to regulatory restrictions rather than to health concerns themselves. The study concludes that innovation and development investments, particularly those reducing energy cost exposure, are important for the sustainability of the spa industry. Results are specific to the Debrecen complex, are based on three panel units, and cannot be generalised to other facilities.

Key-Words: Spa, tourism, COVID-19, war, panel regression, Debrecen, Hungary.

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1 Introduction

The tourism sector is one of the fastest-growing industries of the 21st century, contributing 10.1% to the European economy in 2019; however, this contribution fell by 42.3% in 2020 due to COVID-19 containment measures [1]. In 2021 and the first months of 2022, tourism showed a renewed recovery compared to the historic low in 2020. Although most tourism professionals expected a strong bounce-back in the sector, a UNWTO study published in early 2022 [2] found that the Russian-Ukrainian war, which erupted at the end of February 2022, overturned this. In 2023, the contribution of the European tourism sector to GDP (9.7%) will remain below the 2019 figure [1].

In line with international and European trends, domestic tourism trends were positive in Hungary in 2019, with tourism's contribution to GDP reaching 6.4% [3]. The COVID-19 pandemic and the associated restrictive measures caused a sharp decline in the sector for much of 2020, with its contribution to GDP falling to 5.4%. The output of tourism-specific sectors in 2020 was 16% lower in basic prices than in the previous year, with the decline rate significantly exceeding the national economy's contraction as a whole [4]. From 2021 onwards, Hungary also saw a tourism recovery, with

the sector's 2022 performance narrowly approaching its best year, 2019. Domestic visitors generated 73% of rural tourism, while Budapest was mainly visited by foreigners, with 82% coming from abroad [5]. In 2023, domestic tourism continued to flourish, with most visitors choosing Mátra-Bükk, the Budapest area, Debrecen and its surroundings, Tokaj and Nyíregyháza, and Balaton. Debrecen and its surroundings were also very popular with foreign visitors, who preferred this area immediately after Balaton [6].

Debrecen is the second largest city in Hungary, located in the northern part of the country. The city is a vibrant cultural center, but is also at the forefront of organising and hosting scientific and sporting events, and is a center for intelligent transport management developments related to the automotive industry [7]. In terms of tourism, it differs from the country's traditional tourist regions, as it lacks natural values in the classical sense, except for hot water that emerges from a depth of 1,737 meters [8]. Furthermore, although thermal water is an essential treasure of the Northern Great Plain region, it is not a significant focus in Debrecen. Hence, the city is not a classic spa tourism destination. [9]. Debrecen's diversity has put it on Hungary's tourist map. The target group of the spa complex is mainly families with one or more children.

Debrecen's Nagyerdő is a Natura 2000 nationally protected natural area whose park-forest is part of the everyday recreation of the locals [10]. The Nagyerdei Baths began operating in 1826, and since then, it has undergone many expansions, renovations, and modernisation processes. Today's spa complex has carried the Aquaticum brand name since 2003. It offers a particular outdoor aqua park, a thermal bath, an indoor Mediterranean Aquapark and a four-star hotel for relaxation, rejuvenation and recreation.

The global tourism industry, and the spa and wellness tourism sector, has been characterised by almost a decade of uninterrupted growth [11], [12]. Although there were some minor bumps in the road in the early 2000s, such as the SARS (severe acute respiratory syndrome) outbreak in 2003 [13], and the global financial crisis in 2009, in spring 2020 the tourism sector (and all other economic sectors) faced a more severe crisis than ever before, and the worst year in the history of tourism [14]. On 11 March 2020, the World Health Organisation declared SARS-CoV-2, also known as COVID-19, a global epidemic. [15]. On the same day, the Hungarian government declared a state of emergency and a public health emergency throughout the country [16]. The decree was followed by a series of restrictive measures, including limits on daily activities, encounters, and personal contact, as reported in the news and media, that halted daily life. [17], [18]. The provisions had severe economic and social consequences, including an impact on all forms of tourism.

The Aquaticum complex in Debrecen also initially decided to close down completely, which suddenly seemed the right solution, but this was not sustainable for a long time, neither economically nor socially. With the onset of summer, the country seemed to recover; the country put austerity measures behind us, and life resumed at the Aquaticum complex. However, the autumn months brought further restrictive measures, such as a ban on organising events, the reception of business travelers only, the closure of the spa units, and then the hotel. Restrictions gradually lifted in the first half of 2021. However, some prevention mechanisms remained in place, e.g., the obligation to wear masks in specific locations and more intensive cleaning and disinfection processes. Towards the end of the year, a new wave 4 of the epidemic will again put the complex in a difficult situation, with restrictive measures resulting in cancellations and rescheduling of events planned for the autumn, mostly from 2020.

2022 focused on recovering from the COVID-19 epidemic and dealing with the consequences of the Russian-Ukrainian war. Escalating energy prices and inflation related to the energy crisis are the biggest challenges for the Aquaticum complex. Economic operations have become critical, and the complex has sought to address this challenge by exploring alternative energy options. Although 2022 surpassed 2019 in terms of visitor numbers, the record revenues were almost entirely eroded by increased energy prices and inflation. By 2023, the situation had returned to normal, with foreign visitors returning and significant investments in the Debrecen area playing a pivotal role.

Several studies analysed the impact of the COVID-19 pandemic and the Russian-Ukrainian war conflict in 2022 on the services sector [19], [20], [21], [22], [23], [24]. Narrowing down our search and focusing specifically on the tourism sector in the context of the COVID-19 epidemic, some international studies and reports have found that it has significantly changed leisure (and not exclusively) travel patterns and destination preferences, shifting them towards domestic tourism [25], [26], [27], [28]. [29] conducted a study on destination choice in Hungary and came to a slightly different conclusion from the above-mentioned

studies. There was no change in the choice of destination, and the main influencing factors were convenience and safety. However, it is undeniable that the restrictive mobility-limiting measures introduced in connection with the epidemic (especially in the area of travel abroad) have significantly reduced the number of visitors from abroad and the number of visitors traveling abroad, also in the case of Hungary [30]. According to the research of [31], the Hungarian districts most exposed to the harmful effects of the COVID-19 epidemic in Hungary - the most visited by domestic and foreign tourists - included Debrecen and its region, along with Lake Balaton, Bük-Sárvár, Sopron-Fertő, Győr-Pannonhalma and Mátra-Bükk.

In the context of the Russian-Ukrainian war, [32] notes that Europe's goal is economic independence, and the tourism sector will follow suit. The resulting loss of revenue is likely to be compensated for by higher margins. [33] point out that dependence on Russian energy concerns European countries, especially developing countries. The war's impact on global industries reduces demand due to higher energy prices and pressures asset prices amid investor uncertainty. [34] highlights the tourism sector's exposure, which depends on people's discretionary income and related travel. [35] points out that increased energy prices have made operational optimisation a central issue for those in the tourism sector, especially in the first years of the war. Hungary's extreme exposure to Russian energy sources has created a new challenge for complex operators: to find the best way to operate energy efficiently.

The present study aims to investigate the impact of the measures taken in the context of the COVID-19 epidemic and the impact of the energy crisis caused by the Russian illegal war of aggression against Ukraine on the number of visitors to the year-round facilities of the Aquaticum SPA complex (hotel, thermal baths and indoor Mediterranean Aquapark).

The following two working hypotheses were formulated to investigate the impact of the measures and the energy crisis:
H1: Sales of Aquaticum tickets were reduced by the evolution of COVID-19 active caseloads.
H2: Sales of Aquaticum tickets were reduced by escalating the conflict between Russia and Ukraine.

Because the outdoor waterpark unit of the complex opens seasonally, this unit was not investigated for methodological reasons due to space limitations.

2 Data and Methods

2.1 Data

Data were collected from the Worldometers.info database for COVID-19 active case numbers [36], the Eurostat databases for natural gas prices [37], Decisions of the Municipality of the City of Debrecen concerning the restriction of the operation of the Aquaticum complex [38], core inflation in Hungary [39], net average salary in the Northern Great Plains region [40] and the sales records of the Aquaticum SPA complex for the period between 1 January 2019 and 31 December 2023 were provided by the company's sales department. The sales data were provided in the monthly breakdown.

During the present research, ten variables were analysed. Nine independent variables and one dependent variable were used:

(1) the number of COVID-19 active cases in Hungary (monthly data);
(2) a COVID-19 lockdown (yes/no);
(3) the obligation of wearing the mask (yes/no);
(4) COVID-19 vaccine card for employees (yes/no);
(5) COVID-19 vaccine card for guests (yes/no);
(6) Russian-Ukrainian war (yes/no);
(7) core inflation in Hungary;
(8) gas price for non-household customers (megawatt, USD);
(9) net average salary in the Northern Great Plains region (thousand HUF).

The 10th dependent variable is represented by the number of guests at the Aquaticum Hotel, Thermal Bath, and indoor Mediterranean Aquapark (monthly data). The research covers the period between 2019 and 2023. The methods used for the analysis are descriptive statistics and a panel regression model, where the dependent variables are the monthly sales data (number of visitors) of the Thermal Bath, the indoor Mediterranean Aquapark, and the Aquaticum Hotel.

2.2 Panel Regression Model

The Hausman test favoured the fixed-effects specification ($\chi^2(1) = 5.32$, $p = 0.0211$); since the variance-difference matrix was not positive definite, the test is indicative only, and the fixed- and random-effects coefficient estimates are in any case nearly identical. Taken at face value, the result indicates that the individual effects are correlated with the regressors, which violates the random-effects assumption [41]; the fixed-effects estimator was therefore preferred. The general equation of the

fixed effects model is described in Equation 1:

$$y_{it} = \beta_0 + \beta_1 x_{it1} + \beta_2 x_{it2} + \cdots + \beta_k x_{itk} + a_i + u_{it}, \quad (1)$$

Where *i* represents the number of units observed, *k* is the number of explanatory variables, and *t* represents the number of periods (*t=1,2,…, T*). The effect of time-invariant factors that affect the variable y_{it} is denoted by a_i and is called the unobserved effect. u_{it} refers to factors that vary in time and affect the outcome variable. The error term u_{it} is usually called the idiosyncratic error or the time-varying error [42]. Based on this, the panel regression model is structured as follows:

$$tickets_{it} = \beta_0 + \beta_1 \text{ Active cases}_{it1} + \beta_2 \text{ Lockdowns}_{it2} + \beta_3 \text{ Mask wearing}_{it3} + \beta_4 \text{ Vaccine card_e}_{it4} + \beta_5 \text{ Vaccine card_g}_{it5} + \beta_6 \text{ War}_{it6} + \beta_7 \text{ Core inflation}_{it7} + \beta_8 \text{ Gas}_{it8} + +\beta_9 \text{Salary}_{it9} + a_i + u_{it}, \quad (2)$$

where *t=1,2,..., 60*, since the research is based on five years of monthly data, and *i=1,2,3* represents the units observed: the Thermal bath, the indoor Mediterranean Aquapark, and the Aquaticum Hotel.

Pesaran cross-sectional dependence test was used to test the cross-sectional correlation between variables [43] and the Wooldridge test for serial correlation in the idiosyncratic errors of a linear panel-data model [44]. In addition, the Breusch–Pagan LM test of residual independence, the modified Wald test for groupwise heteroskedasticity and variance inflation factors (VIF) from a pooled OLS model were computed.

3 Results

The guest data of the Aquaticum SPA complex for 2019 - 2023 are shown in Table 1. The first year, 2019, can serve as a reference year, as it was free of disturbances.

Fig. 1 summarises the number of visitors to the Aquaticum SPA complex's bath units and the evolution of COVID-19 active case numbers between 2019 and 2023, month by month. Ticket numbers for the Thermal Bath and the Indoor Aquapark are plotted on the left-hand axis, while the number of active COVID-19 cases in Hungary is plotted on the right-hand axis; the visible troughs in visitor numbers coincide with the periods of mandatory closure listed in Table 2 rather than with the peaks in active case numbers themselves.

2021 was no different, with the pandemic's third and fourth waves. Restrictive measures, such as total or partial closures, travel restrictions, and the requirement to show a vaccination card, kept visitors away. Until May 2021, the spa units were closed, and only the hotel was open for business and health reasons. In May 2021, the legislation will allow the complex to reopen, but guests must present a COVID-19 vaccination certificate. From November 2021, the fourth wave of the pandemic will sweep away corporate events, conferences, and events that have already been rescheduled from 2020. Individual travelers will again be canceled, and another downward spiral will follow (Fig. 1).

Table 1. The number of visitors to the Aquaticum SPA complex between 2019 and 2023

	2019	2020	2021	2022	2023
Thermal Hotel (room nights sold)	24 616	13 537	17 717	23 863	23 848
Thermal bath (number of visitors)	205 699	88 303	93 400	166 928	178 729
Mediterranean Aquapark (number of visitors)	137 193	48 948	55 933	110 001	129 985

Source: Aquaticum SPA sales records

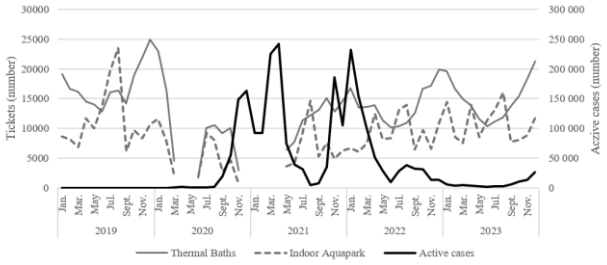


Fig. 1: Bath ticket numbers and Active cases (2019-2023)
Source: Author's own computation

In 2022, the problem was no longer the number of visitors, although the fifth and sixth waves of COVID-19 spread across the country. The steady rise in vaccinated people has meant that the restrictive measures have been lifted, and domestic visitors are gradually returning (Fig. 1.). Despite this, the complex is facing new difficulties: the energy crisis caused by the Russian-Ukrainian war and inflation are causing operational problems.

In 2023, things will start to get back on track. Foreign visitors will return, but domestic visitors will decrease. Foreign tourists will mainly come from the surrounding countries, but not exclusively; with the return of the previous (2019) regular airport flights, Israeli and German tourists will return. However, most will be business travelers. This explains the hotel's occupancy rate of over 80%.

The operation of the Aquaticum SPA complex in Debrecen has been significantly affected by the government's restrictive measures, which are summarised in Table 2.

Table 2. Restrictive measures in the indoor units of the Aquaticum SPA complex

Measures for Bath	Begin	End
Total closure I.	13.03.2020	22.06.2020
Total closure II.	10.11.2020	01.05.2021
Mask wearing	01.11.2020	30.04.2021
Guest with a COVID-19 vaccination	01.05.2021	30.06.2021
Employees with a COVID-19 vaccination	01.05.2021	30.06.2021
Measures for the Hotel	**Begin**	**End**
Total closure I.	20.03.2020	12.06.2020
Total closure II.	20.12.2020	02.07.2021
Event ban I.	01.09.2020	02.07.2021
Event ban II.	01.11.2021	31.12.2021
Only business travelers	09.11.2020	30.04.2021
Guest with a COVID-19 vaccination	01.05.2021	02.07.2021

Source: Author's own computation

After collecting the data, descriptive statistical indicators were calculated (Table 3). Since the Aquaticum SPA complex has three observed indoor units over five years (60 months), the number of items is N=180. Five explanatory variables are constructed so that if a given condition is met, they take the value 1; otherwise, they are 0. For the dependent variable (Tickets), however, N=164, since no sales data exist for the months during which a given unit was fully closed (Table 2); these months were therefore treated as missing observations rather than coded as zero.

Table 3. Descriptive statistics

Variable	Unit	N	Mean	Stand. dev.	Min.	Max.
Active cases[1]	Quantity	180	39051	63188	0	241429
COVID-19 lockdowns[2]	Dummy variable	180	0.17	0.37	0	1
Mask wearing[3]	Dummy variable	180	0.13	0.34	0	1
Vaccine card - employee[4]	Dummy variable	180	0.17	0.37	0	1
Vaccine card - guest[5]	Dummy variable	180	0.03	0.18	0	1
Russian - Ukraine war [6]	Dummy variable	180	0.38	0.49	0	1
Core inflation (Hungary)	Percent	180	8.92	6.63	3.10	18.20
Gas, TTF	Megawatt, USD	180	4.55	4.50	0.46	20.53
Net average salary in the Northern Great Plains region	Thousand HUF	180	235.99	41.73	182.87	301.92
Tickets	Quantity	164	8041.5	6172.1	321	24919

[1] Number of active cases of COVID19 in Hungary (monthly)
[2] 0 - there was no lockdowns, 1 - the spa complex was closed
[3] 0 - wearing a mask was not mandatory, 1 - wearing a mask was mandatory
[4] 0 - employees do not need Vaccination Certificate, 1 - employees do need Vaccination Certificate
[5] 0 - guest do not need Vaccination Certificate, 1 - guest do need Vaccination Certificate
[6] 0 - there was no war between Russia and Ukraine, 1 - there was war between Russia and Ukraine
Source: Author's own computation

Only 14 months of the period under review were unaffected by the COVID-19 pandemic. Over the whole period, the average monthly number of active cases was 39,051, with the highest value, 241,429, recorded in April 2021. The units were closed for 17% of the period under review due to the COVID-19 pandemic, resulting in a loss of ten months in sales. The obligation to wear a mask was in force for eight months (13% of the period studied). The obligation to show a vaccination certificate was in force for ten months for employees and two months for guests (May and June 2021). The fifth dummy variable relates to the Russian-Ukrainian war and covers 38% of the period studied, 23 months (from February 2022).

Core inflation has increased significantly over the past five years, from 3.10% at the beginning to 15.7% in January 2022 and peaking at 18.2% in the first half of 2023. The natural gas price was 2.1 USD/megawatt-hour (MWh) at the beginning of the period, with a low of 0.46 USD/MWh in 2020 and a high of 20.53 USD/MWh in August 2022. The average energy price was 4.55 USD/MWh.

In Hungary, the average monthly net salary in the Northern Great Plains region is 236000 HUF in the period under review. The average monthly wage was lowest at the beginning of the period (182870 HUF) and then gradually increased, reaching its maximum in the last quarter of 2023 (301920 HUF).

The monthly average number of tickets sold in the three monitored units of the Aquaticum SPA complex during the period under review is 8041. The Thermal Bath sold the most tickets (24919) in December 2019. The complex reached its sales low in December 2020.

3.1 Panel Regression

The fixed-effect panel regression model (Table 4.) estimates that two of the nine explanatory variables tested significantly influenced the outcome variable: COVID-19 lockdowns and the Vaccine card - guest. The COVID-19 outbreak lockdown was estimated to cause more than 7000 monthly guest drop-outs ($\beta_2 = -7046$). The obligation to present the COVID-19 vaccination card caused nearly 4500 monthly drop-outs $\beta_5 = -4470$).

The number of active cases ($\beta_1 = -0.013$), the war between Russia and Ukraine ($\beta_6 = -1989$), the Natural Gas price ($\beta_8 = -24$), and Net average salary in the Northern Great Plains region ($\beta_9 = -37$) have a negative, although not significant ($p>0.05$), effect on the outcome variable. Positive, but not significant, effects are found for Mask-wearing ($\beta_3 = 737$), the Vaccine card for employees ($\beta_4 = 65$), and Core inflation ($\beta_7 =$

383).

According to the first hypothesis, sales of Aquaticum tickets were reduced by the evolution of COVID-19 active caseloads. However, this hypothesis was not fulfilled ($\beta_1 = -0.013, p = 0.137$), Hypothesis H1 was not supported by the data. The second hypothesis, that sales of Aquaticum tickets were reduced by the escalation of conflict between Russia and Ukraine, was not fulfilled either ($\beta_6 = -1989, p = 0.409$). The second hypothesis (H2) was likewise not supported.

Table 4. Fixed Effects Estimation (dependent variable: Tickets)

Independent variables	Coefficient	Standard error	p	95% Confidence interval	
Active cases (β_1)	-0.013	0.008	0.137	-0.029	0.004
COVID-19 lockdowns (β_2)	-7046.114	1153.756	0.000*	-9325.583	-4766.644
Mask wearing (β_3)	737.483	1822.808	0.686	-2863.827	4338.793
Vaccine card - employee (β_4)	64.984	927.443	0.944	-1767.359	1897.326
Vaccine card - guest (β_5)	-4469.998	1964.898	0.024*	-8352.036	-587.960
Russian - Ukraine war (β_6)	-1988.753	2399.646	0.409	-6729.719	2752.213
Core inflation (Hungary) (β_7)	383.196	238.948	0.111	-88.892	855.285
Gas, TTF (β_8)	-23.558	81.351	0.773	-184.283	137.167
Net average salary in the Northern Great Plains region (β_9)	-36.943	23.090	0.112	-82.561	8.676
Constant (β_0)	15075.92	4069.452	0.000	7035.926	23115.91

R-squared: Number of obs = 164
within = 0.3011 Number of groups = 3
between = 0.8477 F(9,152) = 7.28
overall = 0.1112 Prob > F = 0.0000

Source: Author's own computation

To assess the validity of the model assumptions, several diagnostic tests were conducted. Because the panel consists of only three units observed over 60 months, tests developed for large cross-sections are of limited use here. Pesaran's CD test yielded a statistic of −1.068 and an average absolute off-diagonal residual correlation of 0.132, suggesting weak cross-sectional dependence; however, with N = 3, the test's asymptotic basis is not met, so we do not draw inference from its p-value. The Breusch–Pagan LM test, which is better suited to panels with few units and many time periods, likewise indicated no cross-sectional dependence ($\chi^2 = 3.965$, $p = 0.2652$). The Wooldridge test did not detect first-order autocorrelation ($F = 3.062$, $p = 0.2223$). By contrast, the modified Wald test rejected homoskedastic residuals across units ($p < 0.001$), so the standard errors reported in Table 4 should be interpreted with caution. Finally, variance inflation factors computed from a pooled OLS specification indicated severe multicollinearity: core inflation (VIF = 43.65), the war dummy (23.77) and net average salary (16.56) exceed the conventional threshold of 10, and the mean VIF is 11.11.

Multicollinearity does not bias the coefficient estimates but inflates their standard errors; the non-significant coefficients of these variables should therefore be read as imprecise estimates rather than as evidence of no effect.

The fixed effects model exhibited substantial explanatory power. The between R^2 value of 0.8477 indicates that approximately 84.8% of the variation in visitor numbers across the panel units can be explained by the included explanatory variables, while the within R^2 of 0.3011 suggests that the model accounts for around 30.1% of the variation over time within the individual units. These results indicate that the selected variables capture a considerable share of the observed differences in visitor numbers.

The overall significance of the model was confirmed by the F-test ($F(9,152) = 7.28$, $p < 0.001$), indicating that the explanatory variables are jointly significant. Consequently, the null hypothesis that all slope coefficients are equal to zero can be rejected, suggesting that the model provides a statistically meaningful explanation of visitor numbers rather than reflecting random variation in the sample.

4 Discussion

The emergence and spread of COVID-19 have already changed how we live and how we spend our leisure time through the various constraints in place during successive waves [27], [28]. Mobility is the fundamental basis for the functioning of tourism [45]. Several measures restricted the operation of the Aquaticum SPA complex in 2020 and 2021 (Table 2). The Oxford Coronavirus Government Response Tracker (OxCGRT) [46] scored countries based on government containment measures, and Hungary's containment index (Figure 2) was among the most severe during the pandemic. The stringency index ranges from 0 to 100, with higher values indicating stricter containment policies (school and workplace closures, travel restrictions, mask mandates); Figure 2 covers the full study period (2019–2023) and shows that Hungary's index remained elevated throughout 2020–2021, before easing gradually from 2022 onward.

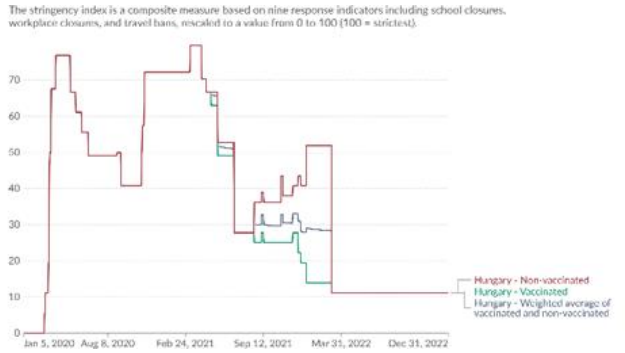


Fig. 2: COVID-19 stringency index in Hungary
Source: Oxford Coronavirus Government Response Tracker (OxCGRT) [46]

The price of natural gas, much of which the EU is forced to import, started to rise as early as the second quarter of 2021, affecting both producer and consumer prices. Between December 2020 and December 2021, imported energy prices more than doubled [37]. On 24 February 2022, Russia launched a full-scale invasion of Ukraine, further aggravating the effect on energy prices [47].

However, the panel regression analysis results indicated that neither the number of active cases nor the war showed a statistically significant effect on the number of visitors. Therefore, the two hypotheses could not be confirmed by our data, however logical and plausible they may seem; given the multicollinearity noted above, the war-related results in particular should be treated as inconclusive. Two of the nine independent variables examined significantly affect the number of visitors: the total closure and the requirement for guests to present a COVID-19 vaccination certificate. Both harmed the number of visitors to the complex. For the other explanatory variables, the effect is not significant.

5 Conclusions

The disruption caused by COVID-19 is unique and cannot be compared to the crises of recent years, neither in duration, scope, nor economic consequences [48], [49]. What is clear, however, is that it has affected both the supply and demand sides of the economy. After the pandemic subsided in February 2022, Russia launched a full-scale invasion of Ukraine, escalating the war. Our research looked at how and to what extent the active cases of the pandemic, the war situation, the resulting inflation, the prices of energy commodities, and the government's restrictive measures have affected attendance at the indoor units of the Aquaticum SPA complex.

Regression is a standard tool for analysing the relationship between variables. It examines how an outcome variable depends on explanatory variables. Since the variables are also observed as a function of time, we used multivariate linear panel regression. Our observations thus consist of some traits of a given individual (units observed) (independent variables), changes in these traits, and the time effect (5 years, 2019-2023). The panel database allows for separate analysis of the time effect and the effects of each data set [50]. Our research hypothesised that the number of visitors to the Aquaticum SPA complex was influenced by the evolution of COVID-19 active case counts and the war in Ukraine. However, our analyses did not detect a statistically significant effect of COVID-19 active caseloads, the war, inflation, or energy prices on visitor numbers; given the high collinearity among the war, inflation, and wage variables, these null results may reflect imprecise estimation. By contrast, among the pandemic restrictions, total closures and the requirement for guests to present a COVID-19 vaccination certificate significantly reduced visitor numbers. The results refer to a single spa complex with three units and should be interpreted with caution, given the limited number of panel units, the heteroskedasticity of the residuals, and the multicollinearity among the explanatory variables.

During the COVID-19 pandemic, tourist arrivals dropped significantly, and foreign visitors were almost absent. While government subsidies helped to mitigate some of the losses due to the absence of visitors, the primary objective of the complex was to retain staff. In the first year of the pandemic, the complex carried out infrastructure maintenance and upgrades and developed a marketing strategy in the hope that 2021 would be encouraging. However, 2021 brought no relief; waves 3 and 4 did not let up, and the same difficulties remained: absenteeism due to closures and out-migration [51]. Although the fifth wave will also peak in January 2022, the population's excellent conversion rates mean government austerity measures will gradually disappear, and guests will return to the complex.
However, there is still no reason to rejoice: although guests can once again enjoy unrestricted use of the hotel and spa, skyrocketing energy prices and war-driven inflation are also driving up the complex's operating costs. Despite the record number of guests, the complex's financial indicators have not been encouraging. A new challenge for the operator is to make the operation economical, reducing energy consumption and eliminating waste. Under these pressures and with a relatively small

investment, they have solved the problem of self-supply of energy and partial coverage of their electricity needs. The units in the complex use energy in several stages; the high-temperature thermal water is used for heating, and additional heat is recovered by recycling the thermal water. Other alternative energy uses are also being considered, with a view to similar cases in the future.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the author(s) utilized artificial intelligence (AI) technologies solely for the purpose of linguistic refinement and grammatical correction. Following the application of these tools, the author(s) comprehensively reviewed, verified, and edited the resulting text. The author(s) maintain full accountability and responsibility for the accuracy, integrity, and final content of the publication.

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